Fig.1.

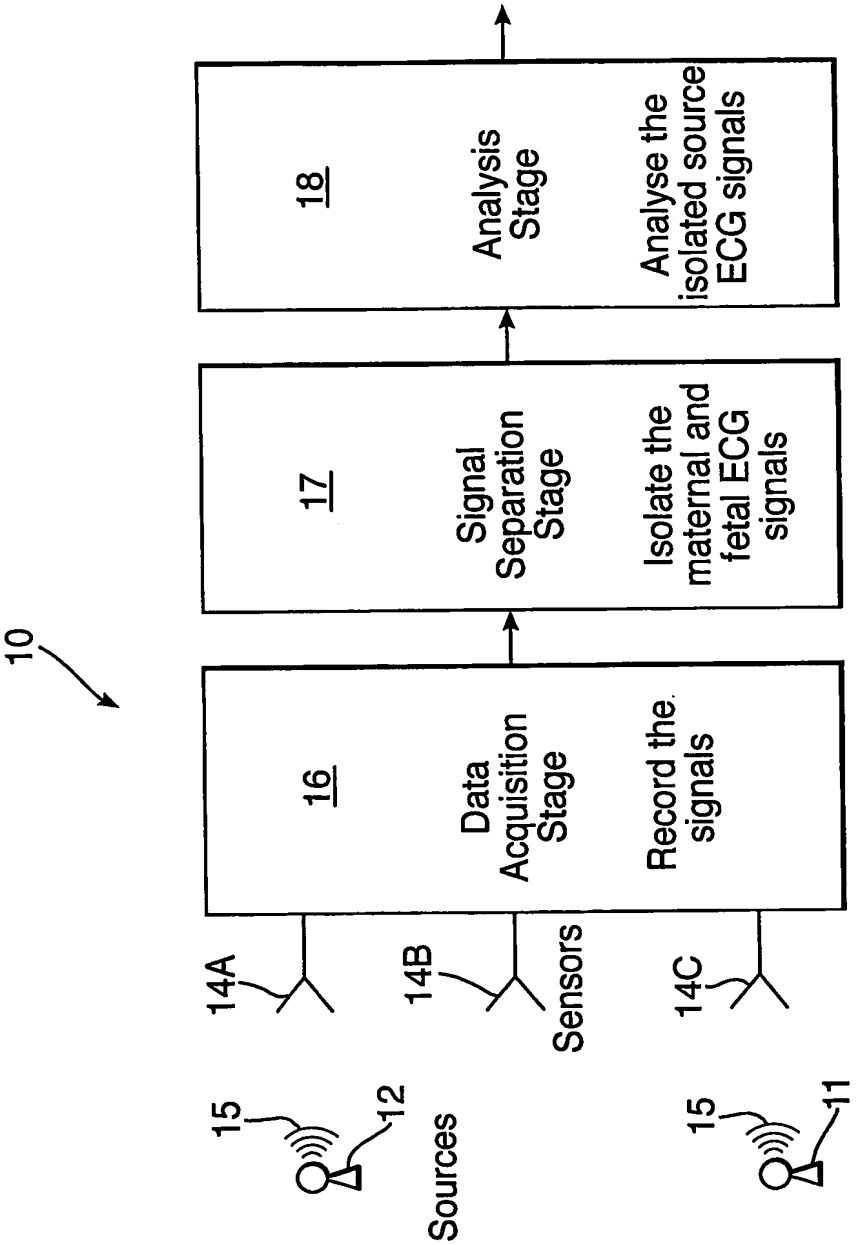

10
16
Data Acquisition Stage
Record the signals
17
Signal Separation Stage
Isolate the maternal and fetal ECG signals
18
Analysis Stage
Analyse the isolated source ECG signals
14A
14B
14C
Sensors
15
12
Sources
15
11

Fig.2a.

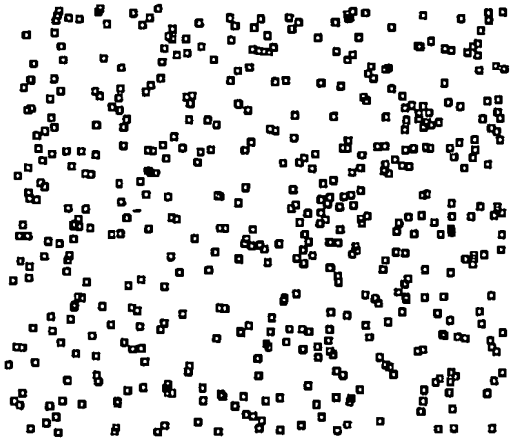


Fig.2b.

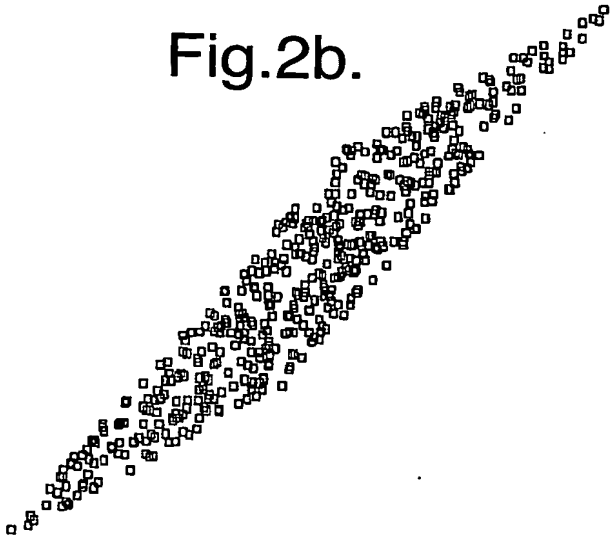


Fig.2c.

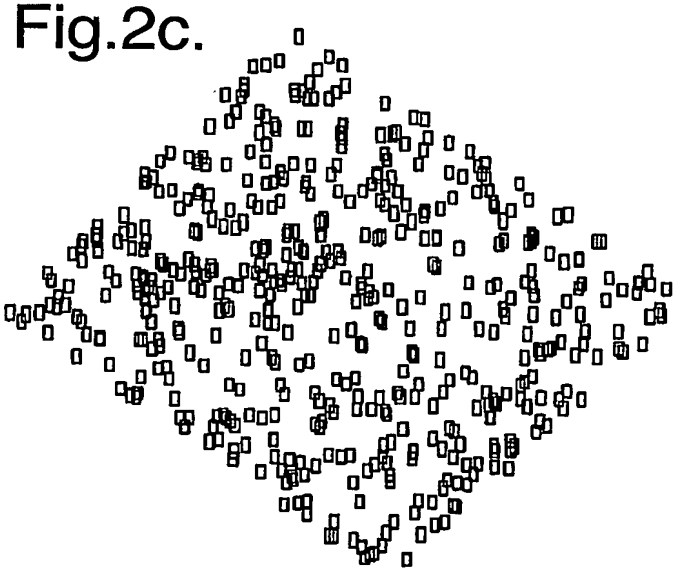


Fig.2d.

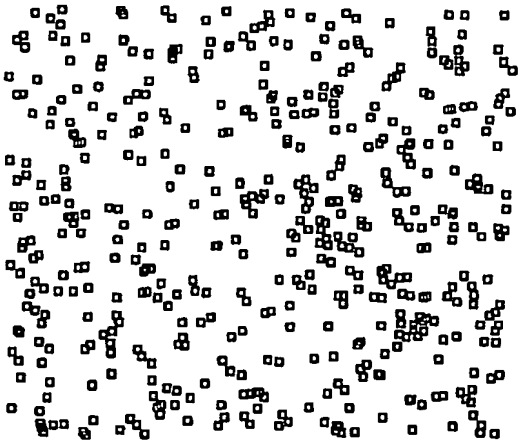


Fig.3.

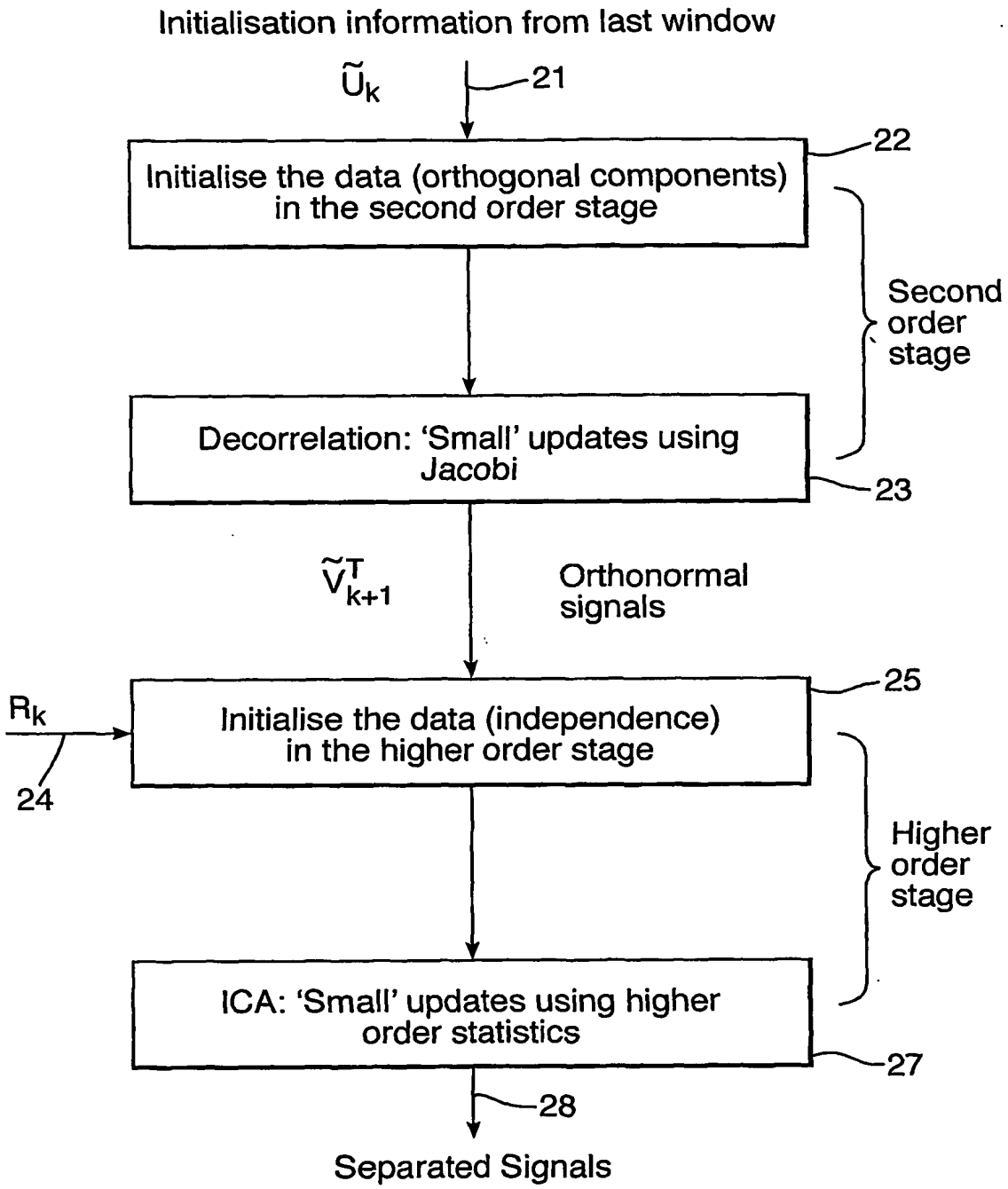

Initialisation information from last window
$\tilde{U}_k$
21
Initialise the data (orthogonal components) in the second order stage
22
Second order stage
Decorrelation: 'Small' updates using Jacobi
23
$\tilde{V}^T_{k+1}$
Orthonormal signals
R_k
24
Initialise the data (independence) in the higher order stage
25
Higher order stage
ICA: 'Small' updates using higher order statistics
27
28
Separated Signals

Fig.4.

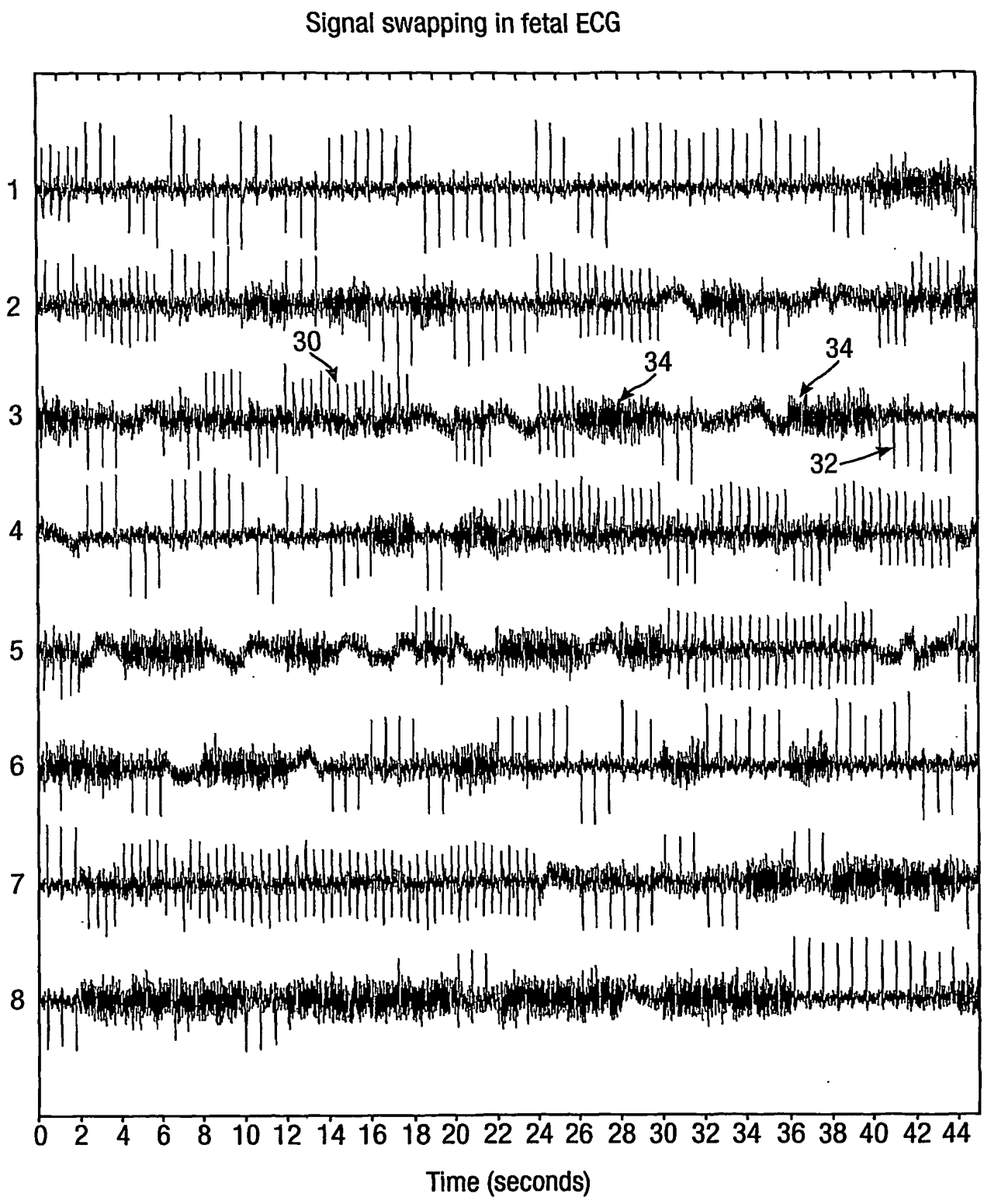

Signal swapping in fetal ECG
1
2
3
4
5
6
7
8
30
34
34
32
0 2 4 6 8 10 12 14 16 18 20 22 24 26 28 30 32 34 36 38 40 42 44
Time (seconds)

Fig.5.

Small update process - second order stage

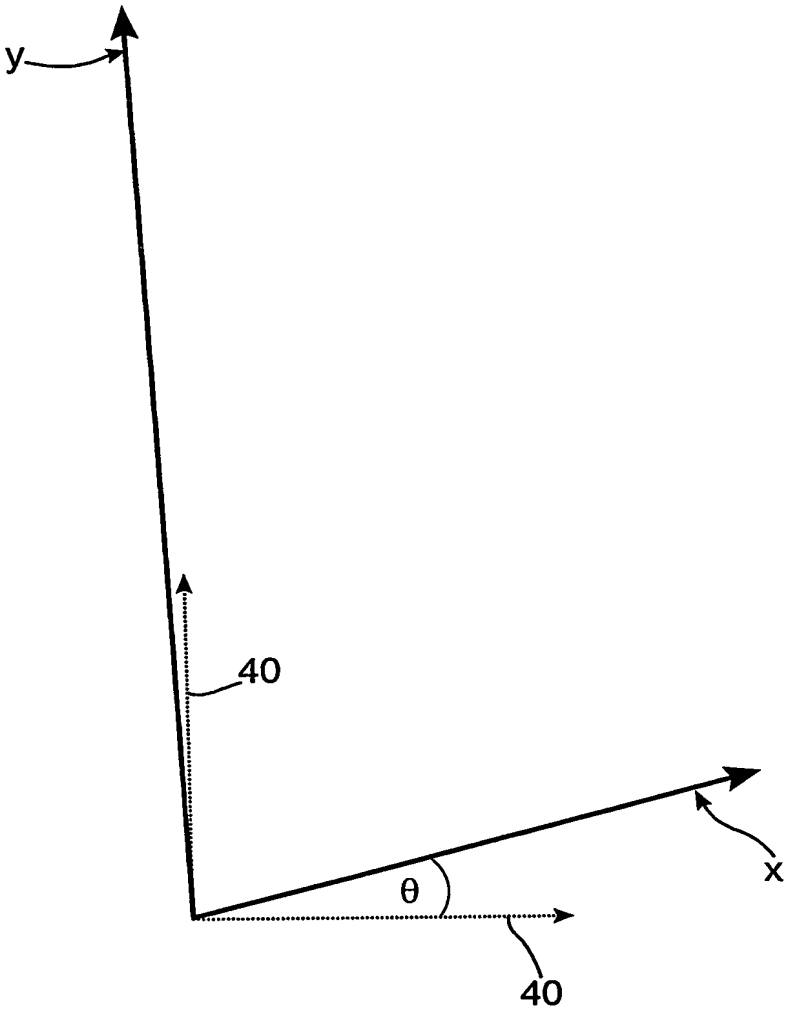


Fig.6.

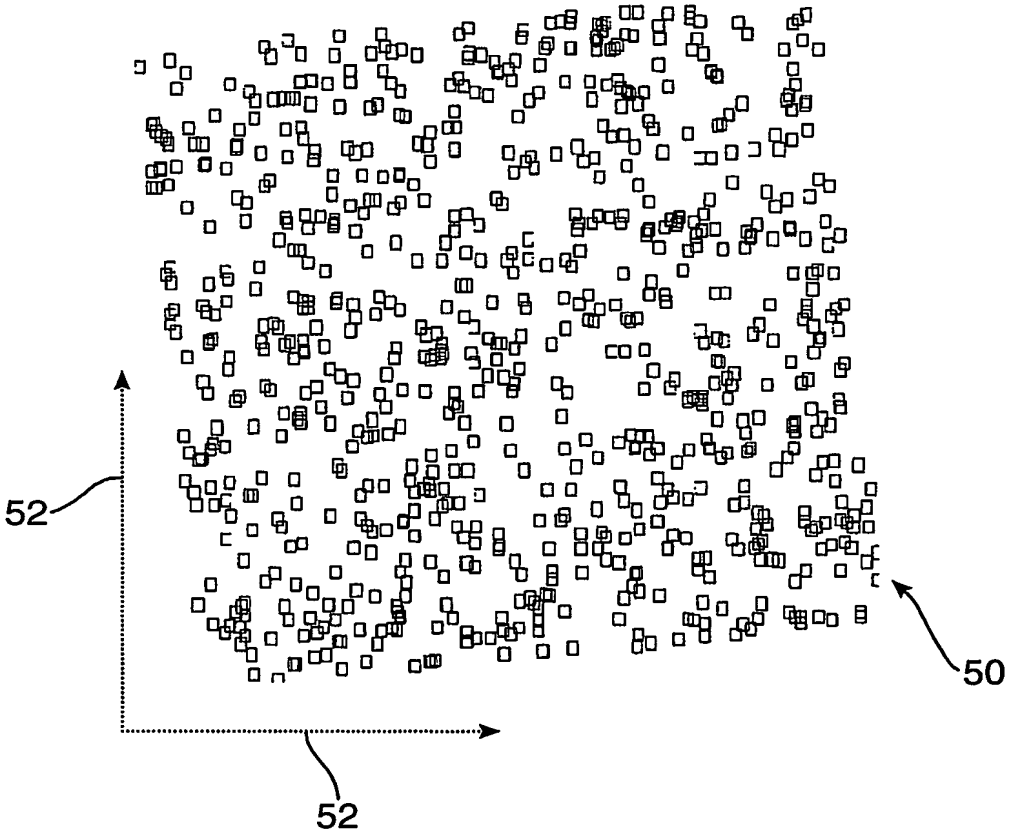


Fig.7.

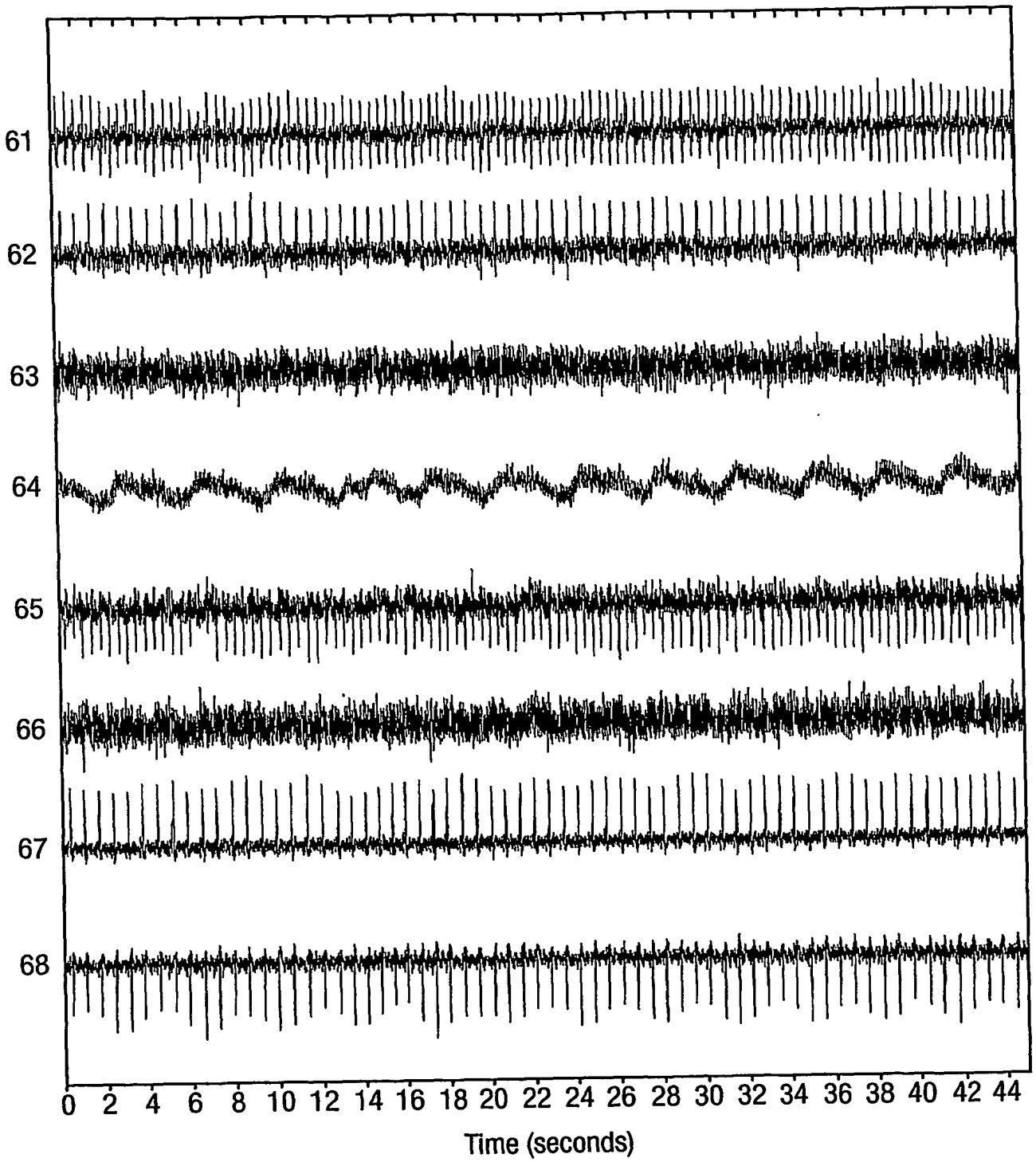

61
62
63
64
65
66
67
68
0 2 4 6 8 10 12 14 16 18 20 22 24 26 28 30 32 34 36 38 40 42 44
Time (seconds)

Fig.8.

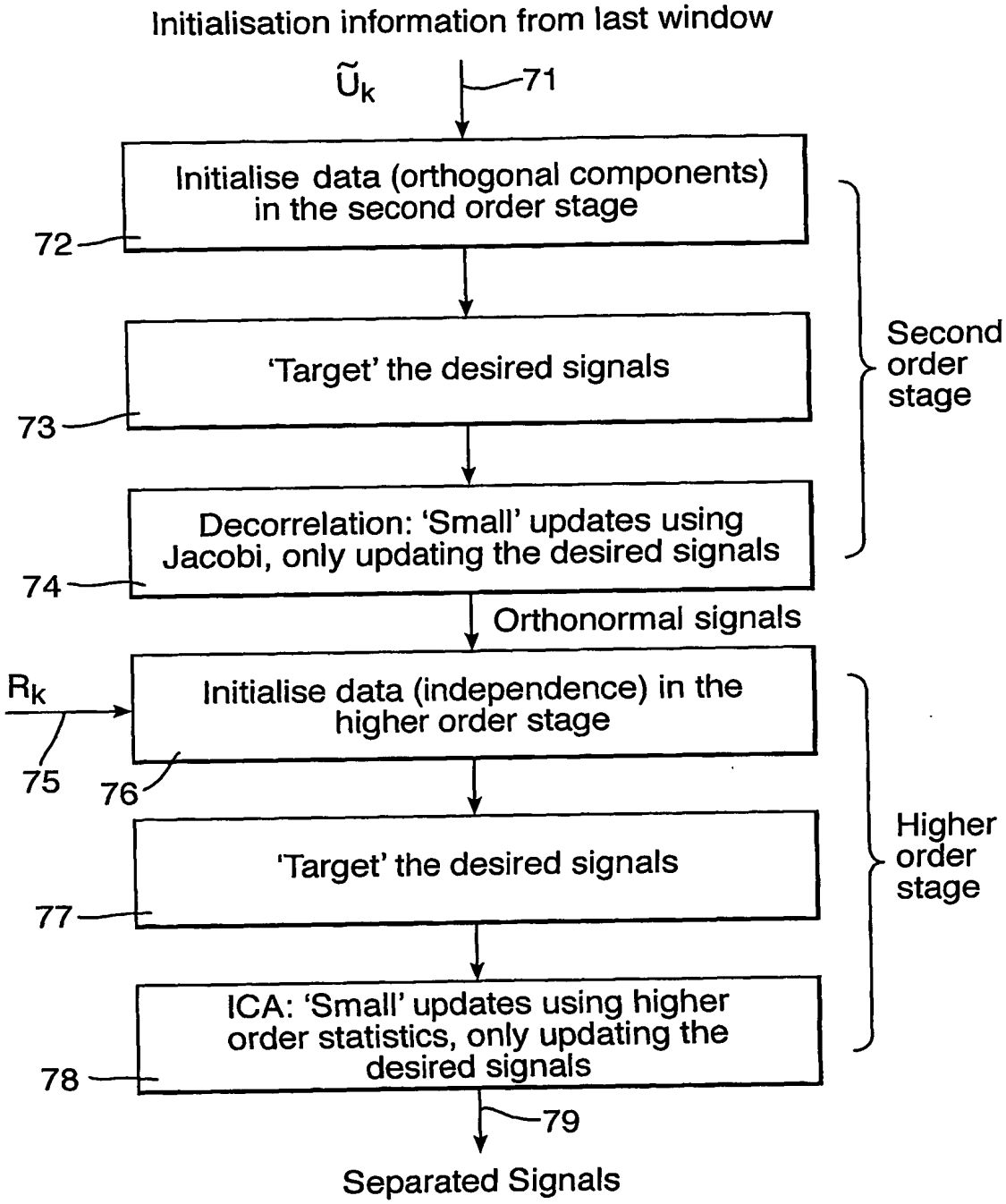

Initialisation information from last window
$\tilde{U}_k$
71
Initialise data (orthogonal components) in the second order stage
72
'Target' the desired signals
73
Decorrelation: 'Small' updates using Jacobi, only updating the desired signals
74
Second order stage
Orthonormal signals
R_k
Initialise data (independence) in the higher order stage
75
76
'Target' the desired signals
77
ICA: 'Small' updates using higher order statistics, only updating the desired signals
78
Higher order stage
79
Separated Signals

Fig.9.

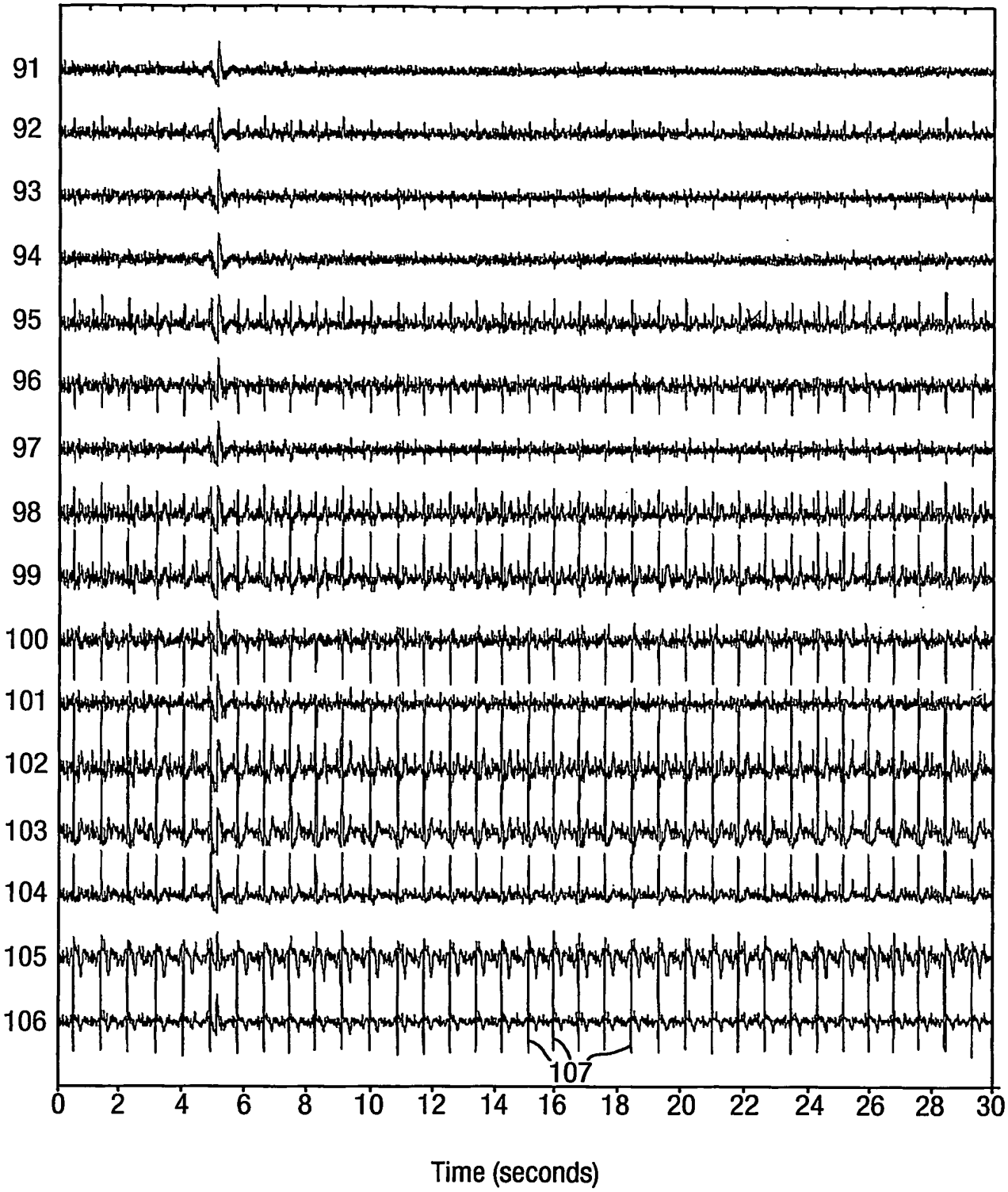

91
92
93
94
95
96
97
98
99
100
101
102
103
104
105
106
107
0
2
4
6
8
10
12
14
16
18
20
22
24
26
28
30
Time (seconds)

Fig.10.

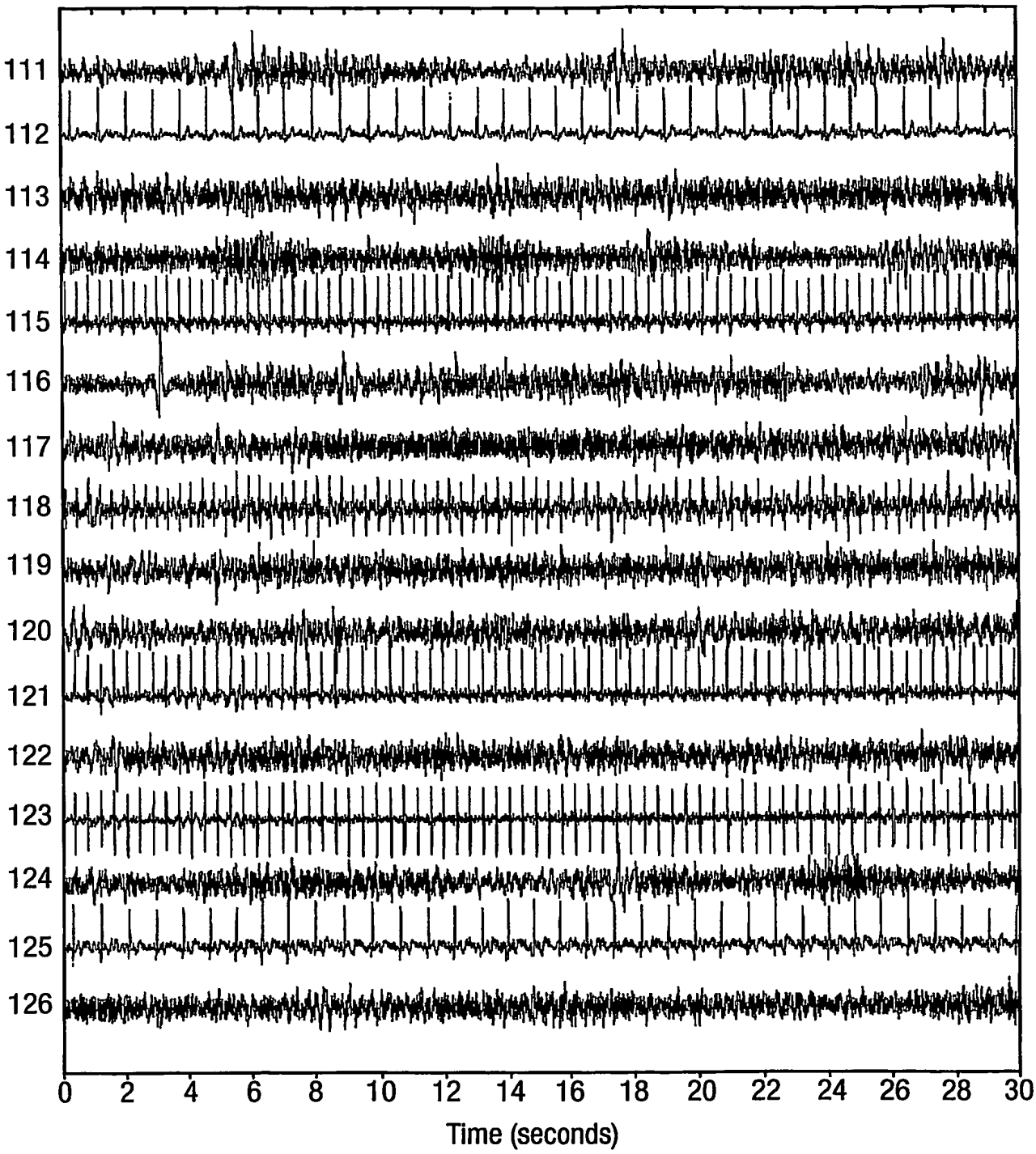

111
112
113
114
115
116
117
118
119
120
121
122
123
124
125
126
0 2 4 6 8 10 12 14 16 18 20 22 24 26 28 30
Time (seconds)

Fig.11.

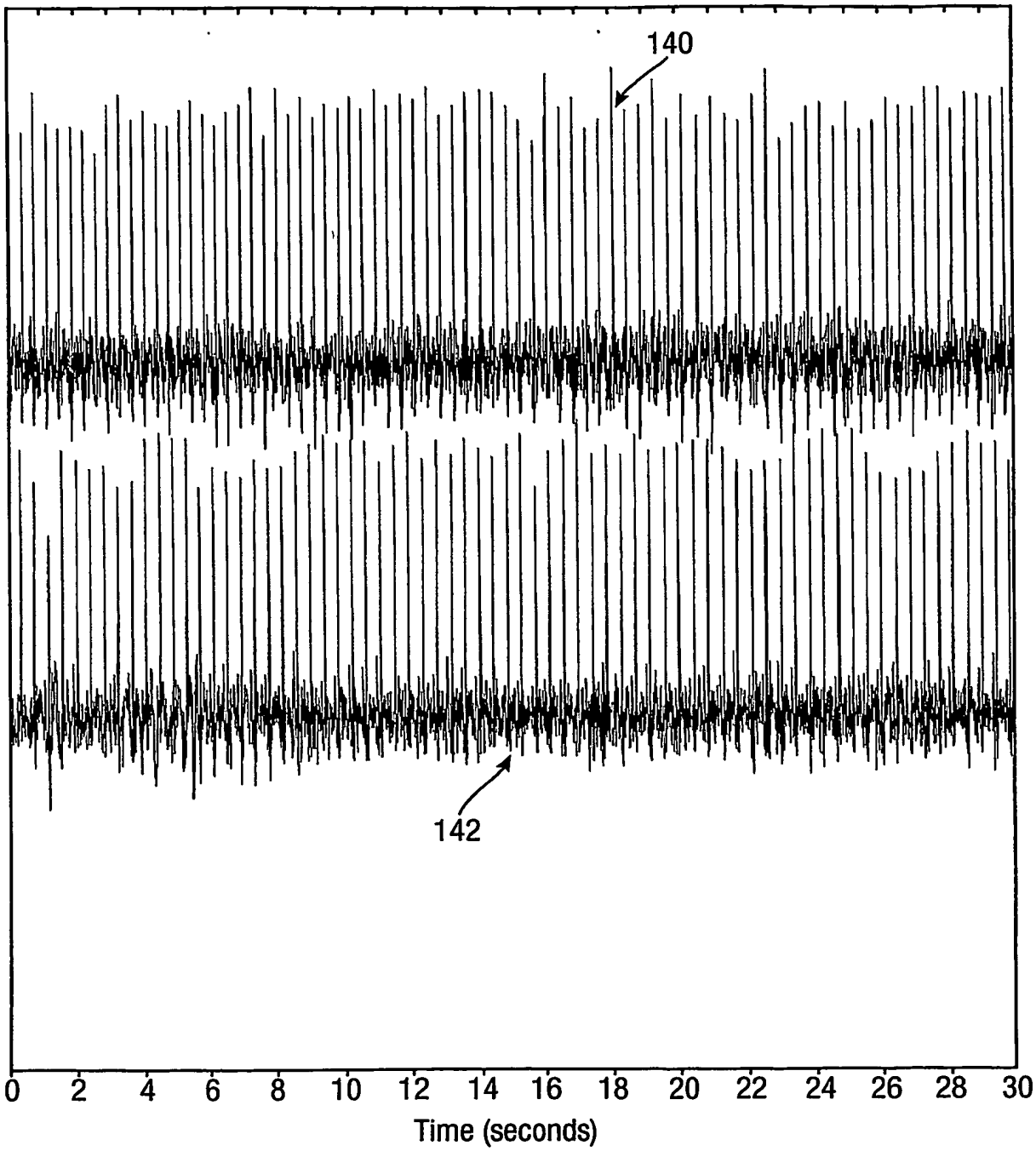


Fig.12.

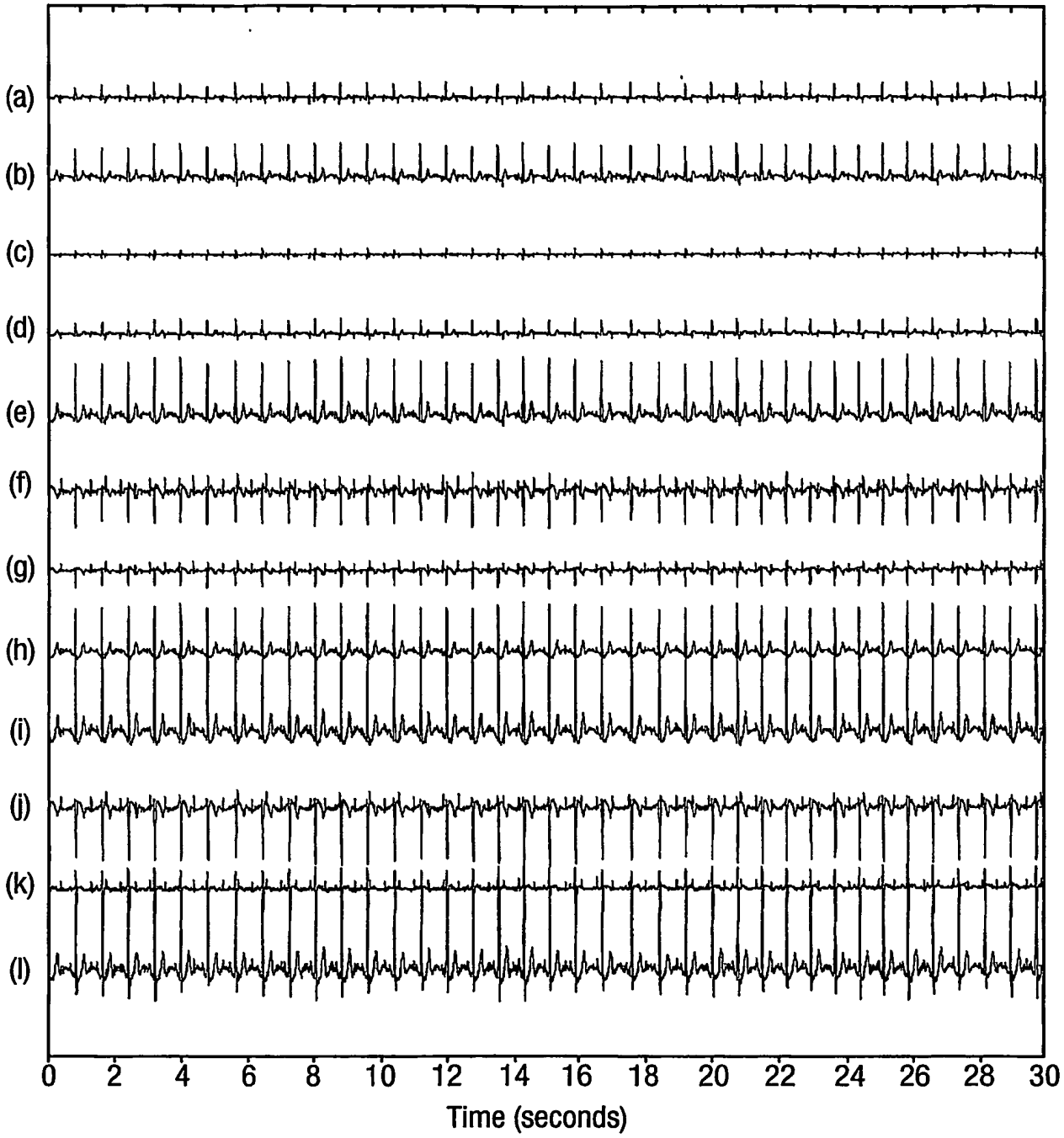

(a)
(b)
(c)
(d)
(e)
(f)
(g)
(h)
(i)
(j)
(k)
(l)
0 2 4 6 8 10 12 14 16 18 20 22 24 26 28 30
Time (seconds)

Fig.13.

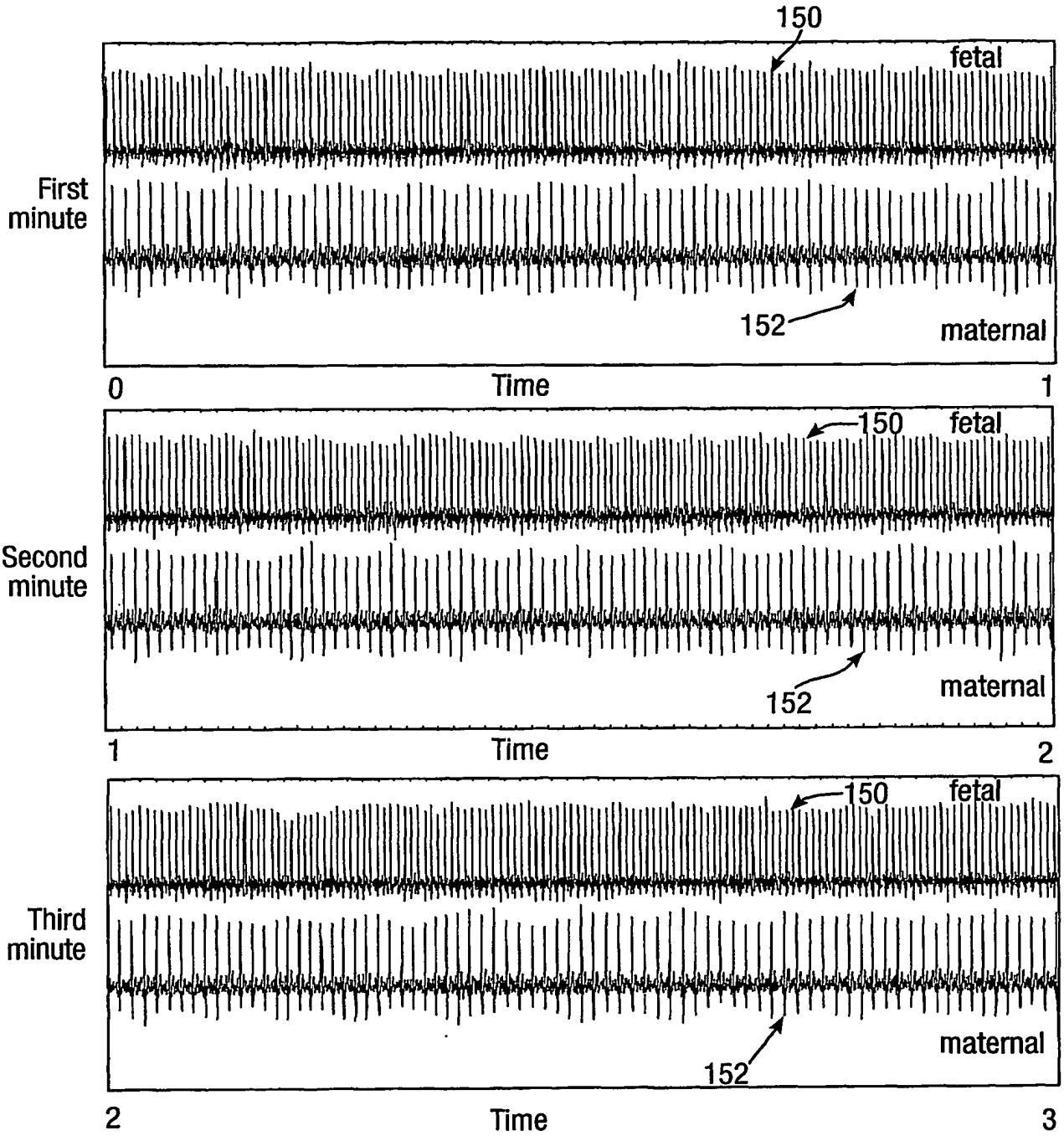

150
fetal
First minute
152
maternal
0
Time
1
150
fetal
Second minute
152
maternal
1
Time
2
150
fetal
Third minute
maternal
152
2
Time
3

Fig.14a.

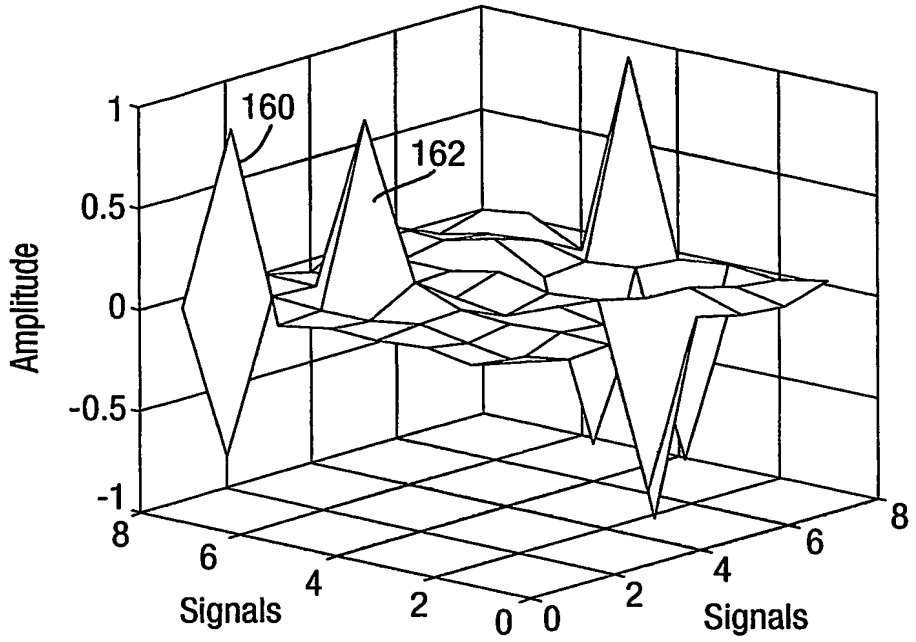


Fig.14b.

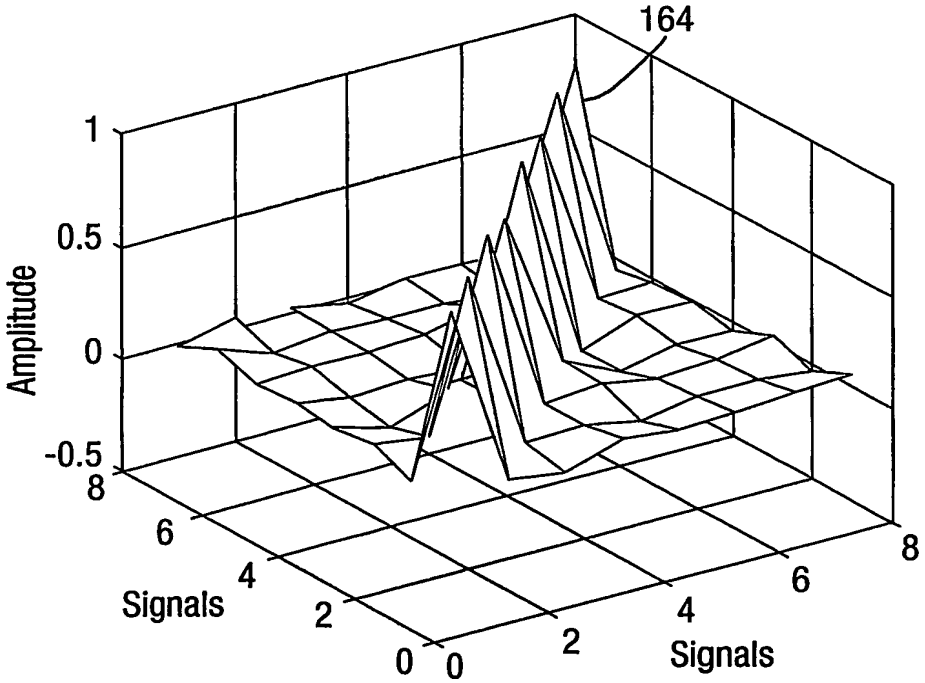


Fig.15.

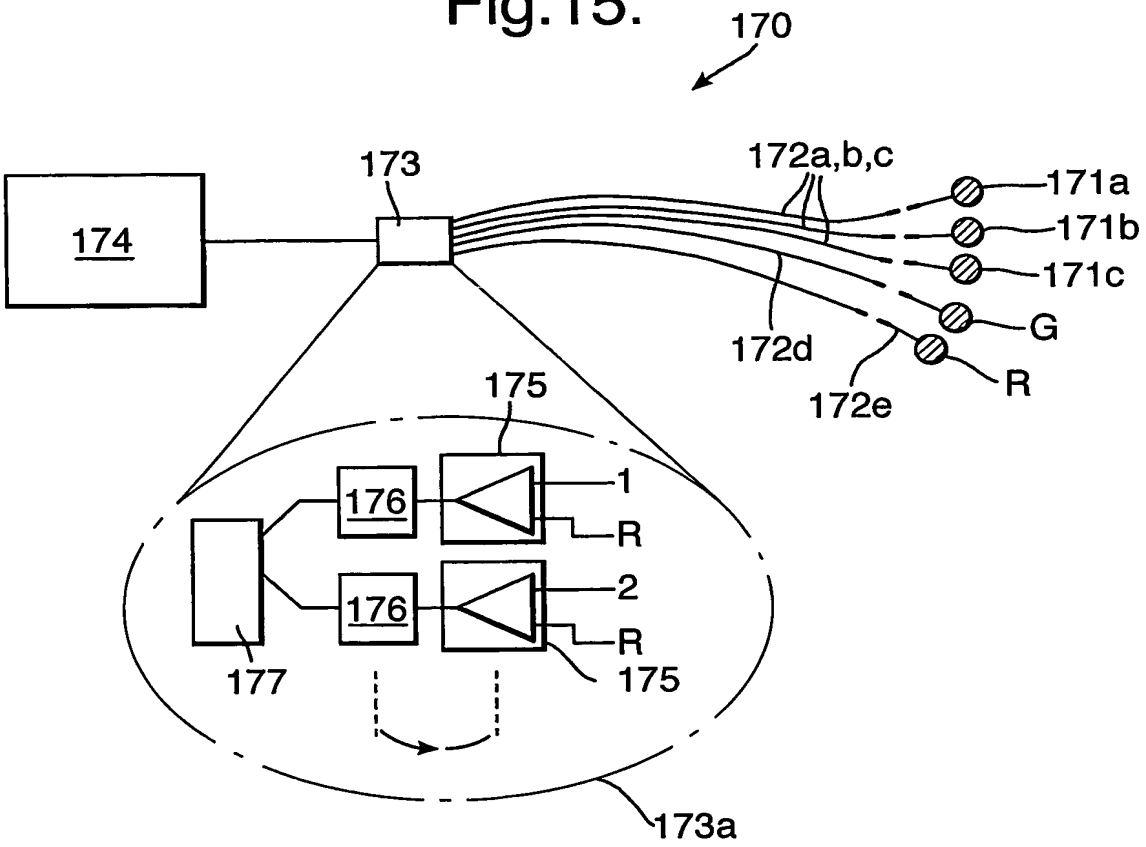

170
173
172a,b,c
171a
171b
171c
G
R
174
172d
172e
175
176
1
R
176
2
R
177
175
173a

Fig.16.

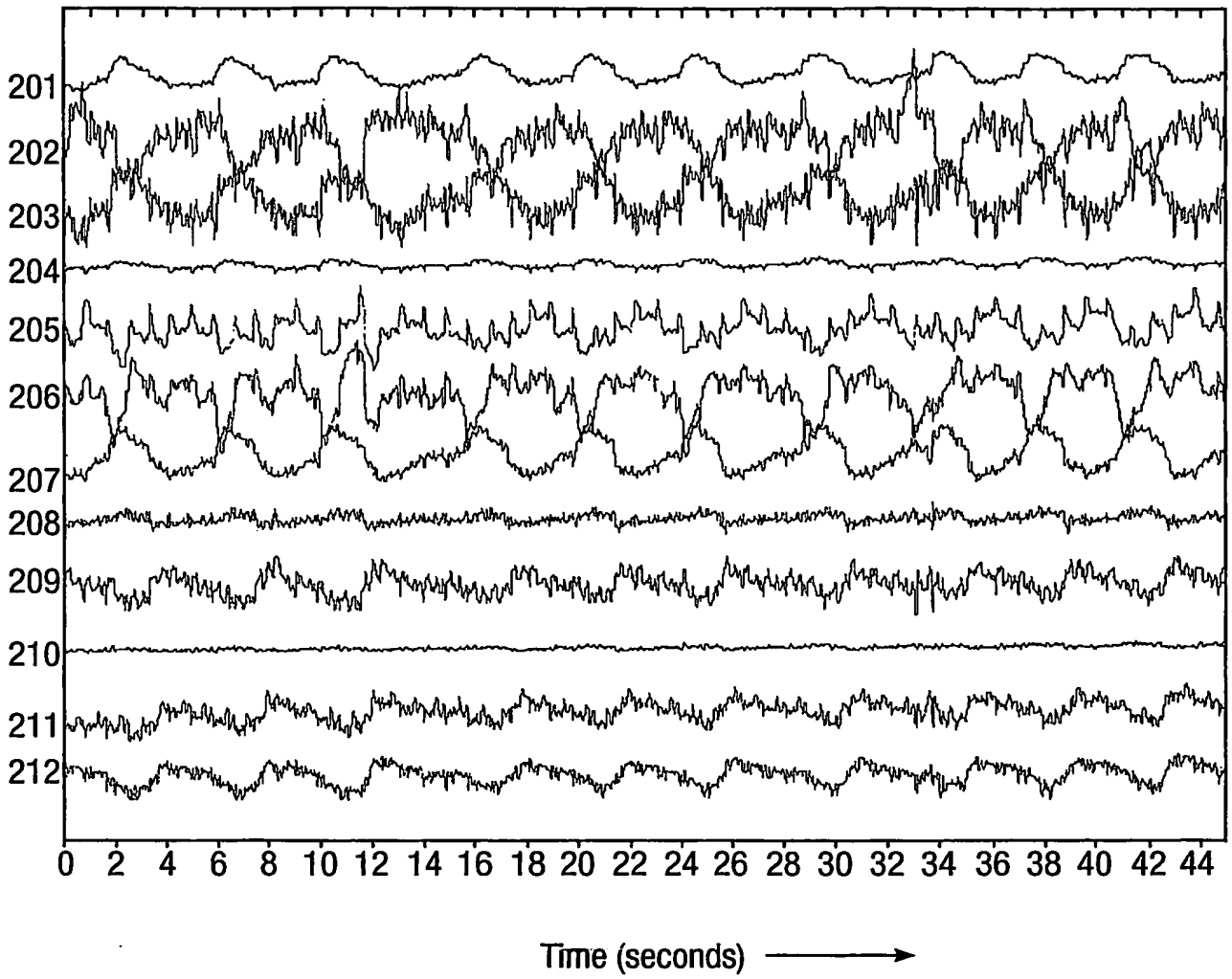
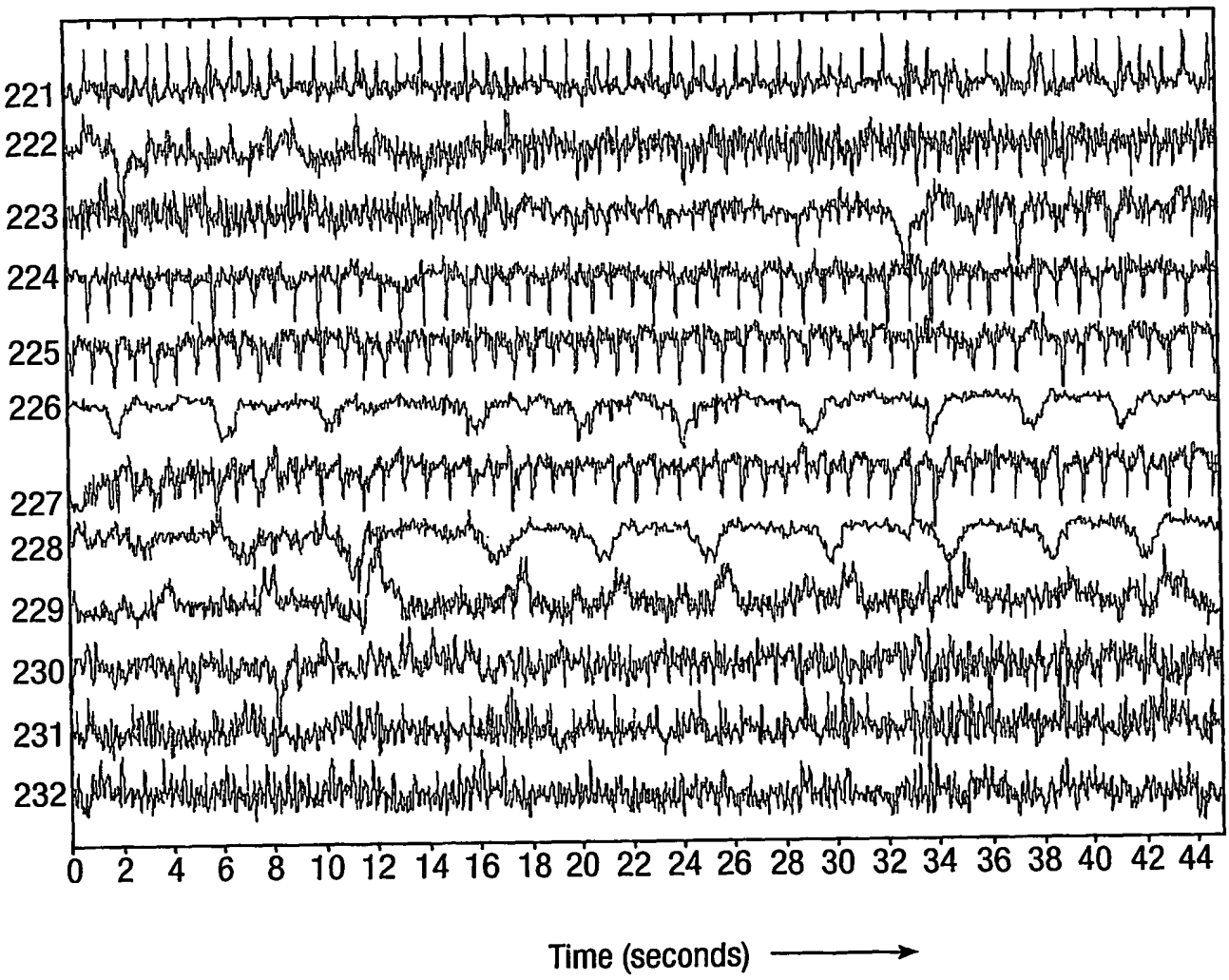

201
202
203
204
205
206
207
208
209
210
211
212
0 2 4 6 8 10 12 14 16 18 20 22 24 26 28 30 32 34 36 38 40 42 44
Time (seconds)

Fig.17.


221
222
223
224
225
226
227
228
229
230
231
232
0 2 4 6 8 10 12 14 16 18 20 22 24 26 28 30 32 34 36 38 40 42 44
Time (seconds)